

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions and listings of claims in the application:

1. (Currently Amended) A method for illuminant compensation of an image ~~including of a human face, wherein the image includes a plurality of color pixels, region-~~ comprising:

determining a face region based on skin color pixels, wherein the skin color pixels are determined based on intensity and chrominance color of the pixels;

determining a surface fitting based on the face region for the image using a linear model, wherein the surface fitting is determined using only the skin color pixels of the face region;

generating an illuminant corrected image using the surface fitting and the image;
and

normalizing the illuminant corrected image to generate an illuminant compensated image.

2-3. (Canceled)

4. (Original) The method of claim 1, wherein the illuminant corrected image is generated by subtracting the surface fitting from the image.

5. (Previously Presented) The method of claim 1, wherein the image includes a plurality of pixels each having a gray level, and wherein the step of normalizing the image, comprises the substeps of:

computing an average gray level for the plurality of pixels in the image;

computing a standard deviation of the gray level for the plurality of pixels in the image; and

transforming the gray level for each pixel of the plurality of pixels to a gray level within a predetermined range using the computed average gray level and the computed standard deviation.

6. (Currently Amended) The method of claim 5, ~~wherein the step of normalizing the image further comprises the substeps of:~~

~~determining for each of the plurality of pixels whether the pixel is part of the face region in the image;~~

wherein in the step of computing the average gray level for the plurality of pixels, only the pixels ~~that are determined to be part of the face region~~ are used in computing the average gray level; and

wherein in the step of computing the standard deviation, only the pixels ~~that are determined to be part of the face region~~ are used in computing the standard deviation.

7. (Canceled)

8. (Currently Amended) A system for illuminant compensation of an image ~~including of a human face, wherein the image includes a plurality of color pixels, region-~~ comprising:

a memory; and

a processor;

wherein the memory stores a program that is operative with the processor to perform the following steps:

determining a face region based on skin color pixels, wherein the skin color pixels are determined based on intensity and chrominance color of the pixels;

determining a surface fitting based on the face region for the image using a linear model, wherein the surface fitting is determined using only the skin color pixels of the face region;

generating an illuminant corrected image using the surface fitting and the image; and

normalizing the illuminant corrected image to generate an illuminant compensated image.

9-10. (Canceled)

11. (Original) The system of claim 8, wherein in the step of generating the illuminant corrected image, the illuminant corrected image is generated by subtracting the surface fitting from the image.

12. (Previously Presented) The system of claim 8, wherein the image includes a plurality of pixels each having a gray level, and wherein the step of normalizing the image, comprises the substeps of:

computing an average gray level for the plurality of pixels in the image;

computing a standard deviation of the gray level for the plurality of pixels in the image; and

transforming the gray level for each pixel of the plurality of pixels to a gray level within a predetermined range using the computed average gray level and the computed standard deviation.

13. (Currently Amended) The system of claim 12, ~~wherein the step of normalizing the image further comprises the substeps of:~~

~~determining for each of the plurality of pixels whether the pixel is part of the face region in the image;~~

wherein in the step of computing the average gray level for the plurality of pixels, only the pixels ~~that are determined to be~~ part of the face region are used in computing the average gray level; and

wherein in the step of computing the standard deviation, only the pixels ~~that are determined to be~~ part of the face region are used in computing the standard deviation.

14. (Canceled)

15. (Currently Amended) A computer readable medium storing a program for illuminant compensation of an image ~~including~~ of a human face region, wherein the image includes a plurality of color pixels and the program is operative with a processor to perform a method comprising the steps of

determining a face region based on skin color pixels, wherein the skin color pixels are determined based on intensity and chrominance color of the pixels;

determining a surface fitting based on the face region for the image using a linear model, wherein the surface fitting is determined using only the skin color pixels of the face region;

generating an illuminant corrected image using the surface fitting and the image;
and

normalizing the illuminant corrected image to generate an illuminant compensated image.

16-17. (Canceled)

18. (Original) The computer readable medium of claim 15, wherein in the step of generating the illuminant corrected image, the illuminant corrected image is generated by subtracting the surface fitting from the image.

19. (Previously Presented) The computer readable medium of claim 15, wherein the image includes a plurality of pixels each having a gray level, and wherein the step of normalizing the image, comprises the substeps of:

computing an average gray level for the plurality of pixels in the image;
computing a standard deviation of the gray level for the plurality of pixels in the image; and
transforming the gray level for each pixel of the plurality of pixels to a gray level within a predetermined range using the computed average gray level and the computed standard deviation.

20. (Currently Amended) The computer readable medium of claim 19, ~~wherein the step of normalizing the image further comprises the substeps of:~~

~~determining for each of the plurality of pixels whether the pixel is part of the face region in the image;~~

wherein in the step of computing the average gray level for the plurality of pixels, only the pixels ~~that are determined to be part~~ of the face region are used in computing the average gray level; and

wherein in the step of computing the standard deviation, only the pixels ~~that are determined to be part~~ of the face region are used in computing the standard deviation.

21. (Canceled)

22. (Currently Amended) A system for illuminant compensation of an image including of a human face, wherein the image includes a plurality of color pixels, ~~region-~~ comprising:

means for determining a face region based on skin color pixels, wherein the skin color pixels are determined based on intensity and chrominance color of the pixels;

means for determining a surface fitting based on the face region for the image using a linear model, wherein the surface fitting is determined using only the skin color pixels of the face region;

means for generating an illuminant corrected image using the surface fitting and the image; and

means for normalizing the illuminant corrected image to generate an illuminant compensated image.

23. (Canceled)

24. (Previously Presented) A system for determining a surface fitting for an image that includes a plurality of pixels each having a color, and wherein the image includes a face region, comprising:

a memory; and

a processor;

wherein the memory stores a program that is operative with a processor to perform a method comprising the steps of:

determining for each pixel whether the pixel's color is within a predetermined set of colors;

determining the pixel to be part of the face region if it is determined that the pixel's color is within the predetermined set of colors; and

determining a surface fitting for the image using a linear model, wherein the surface fitting is determined using only the pixels that were determined to be part of the face region.

25. (Previously Presented) A computer readable medium storing a program that is operative with a processor to perform method for determining a surface fitting for an image that includes a plurality of pixels each having a color, and wherein the image includes a face region, comprising the steps of:

determining for each pixel whether the pixel's color is within a predetermined set of colors;

determining the pixel to be part of the face region if it is determined that the pixel's color is within the predetermined set of colors; and

determining a surface fitting for the image using a linear model, wherein the surface fitting is determined using only the pixels that were determined to be part of the face region.

26. (Previously Presented) A system for determining a surface fitting using a linear model for an image that includes a plurality of pixels each having a color, and wherein the image includes a face region, comprising:

means for determining for each pixel whether the pixel's color is within a predetermined set of colors;

means for determining the pixel to be part of the face region if it is determined that the pixel's color is within the predetermined set of colors; and

means for determining a surface fitting for the image, wherein the surface fitting is determined using only the pixels that were determined to be part of the face region.

27. (Canceled)

28. (Previously Presented) A method for image normalization of an image that includes a plurality of pixels each having a gray level, comprising the steps of:

determining for each of the plurality of pixels whether the pixel is part of a face region in the image;

computing an average gray level for the plurality of pixels in the image using only the pixels that are determined to be part of the face region;

computing a standard deviation of the gray level for the plurality of pixels in the image using only the pixels that are determined to be part of the face region; and

transforming the gray level for each pixel of the plurality of pixels to a gray level within a predetermined range using the computed average gray level and the computed standard deviation.

29. (Original) The method of claim 28, wherein the step of determining whether a pixel is part of the face region includes determining whether the pixel has a skin color.

30-33. (Canceled)

34. (Previously Presented) A computer readable medium storing a program that is operative with a processor to perform a method for image normalization of an image that includes a plurality of pixels each having a gray level, comprising the steps of:

determining for each of the plurality of pixels whether the pixel is part of a face region in the image;

computing an average gray level for the plurality of pixels in the image using only the pixels that are determined to be part of the face region;

computing a standard deviation of the gray level for the plurality of pixels in the image using only the pixels that are determined to be part of the face region; and

transforming the gray level for each pixel of the plurality of pixels to a gray level within a predetermined range using the computed average gray level and the computed standard deviation.

35. (Original) The computer readable medium of claim 34, wherein the step of determining whether a pixel is part of the face region includes determining whether the pixel's color is within a predetermined set of colors.

36. (Canceled)

37. (New) The method of claim 1, further comprising:
inputting the image from electronic sources in real-time.

38. (New) The method of claim 1, further comprising:

deciding that the human face in the illuminant compensated image matches one of a plurality of faces stored in a database.

39. (New) The method of claim 38, further comprising:

outputting the illuminant compensated image and information associated with the matched one of plurality of faces stored in a database.

40. (New) The method of claim 1, wherein the linear model is further simplified by a discrete least-square approximation to avoid extensive computations.

41. (New) A method for classifying human faces contained in a plurality of images, comprising:

extracting a face image from each of the plurality of images;

storing the extracted face images in a database;

normalizing the face images to reduce computational time;

generating illuminant compensated images of the face images;

mapping gray levels of the illuminant compensated images to a predetermined number of linear discriminate analysis (LDA) derived bases to create a feature vector for each of the illuminant compensated images; and

training a neural network to recognize the face images based on the feature vector for each of the illuminant compensated images.

42. (New) The method of claim 41, wherein the neural network is a back propagation three-layer network.

43. (New) The method of claim 41, further comprising:
deriving a recognition rate based on the number of times the face is successfully recognized.